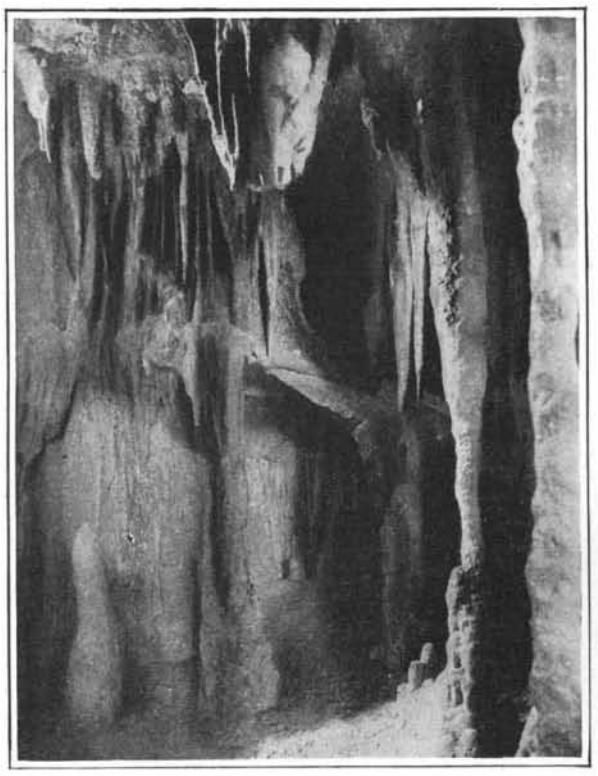
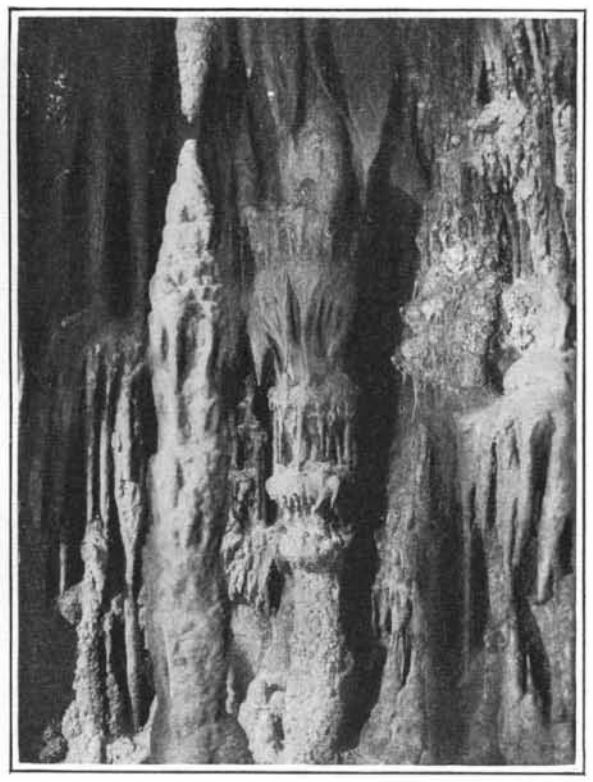


A corner of the miniature cave, with a large stalagmite pillar rising from the floor

A member of the Museum of Natural History staff preparing the miniature cave



Central section of the miniature cave, showing the terrace-like formations

Building a Cave at the American Museum of Natural History

By Walter L. Beasley

A MOST realistic and instructive cave reproduction is now being finished for the Geological Hall of the American Museum of Natural History, New York. It is a miniature of a remarkable newly-discovered grotto just explored in Weyer's Cave, Virginia.

The cave reproduction is faithful in every detail, which makes it at once an impressive and graphic representation of the original one. It is replete with beautiful and fantastic formations of stalagmites which have been carefully removed from the natural cave and transported with great difficulty to the Museum, where they have been assembled in their exact order of occurrence. Thus, as a result of the arduous tasks involved, the cave may be considered as having been virtually transplanted from its natural surroundings to the Museum, where it can be viewed and studied by the visitors.

The fac-simile cave, representing as it does the most advanced and up-to-date type of museum exhibits which impart scientific knowledge in an unusually interesting and efficacious manner, is destined to prove of exceptional educational and popular interest. The author, through the courtesy of Dr. Frederick A. Lucas, Director of the Museum, was afforded the opportunity of securing a series of advance photographs of the artificial cave scenes, which are here reproduced. These views represent the main features of the finished interior of the grotto, which occupies a space seventeen feet long, fourteen feet wide and eleven feet high.

The design, the construction of the artificial grotto, and the arrangement and setting of the many stalagmites have been skillfully performed by William B. Peters of the Staff of Preparation. Over a year of critical and painstaking labor has been devoted to the careful setting and assembling of the numerous stalagmites forming the interior.

Mr. Peters, along with an assistant, visited Weyer's Cave in Virginia in order to accomplish the difficult and somewhat dangerous task of dislodging and removing the weighty formations found on the floor and suspended from the ceiling of the cave chamber. This unexplored grotto, forming the original of the museum exhibit, when opened up was found adorned with a wealth of magnificent yellowish-red stalagmites and

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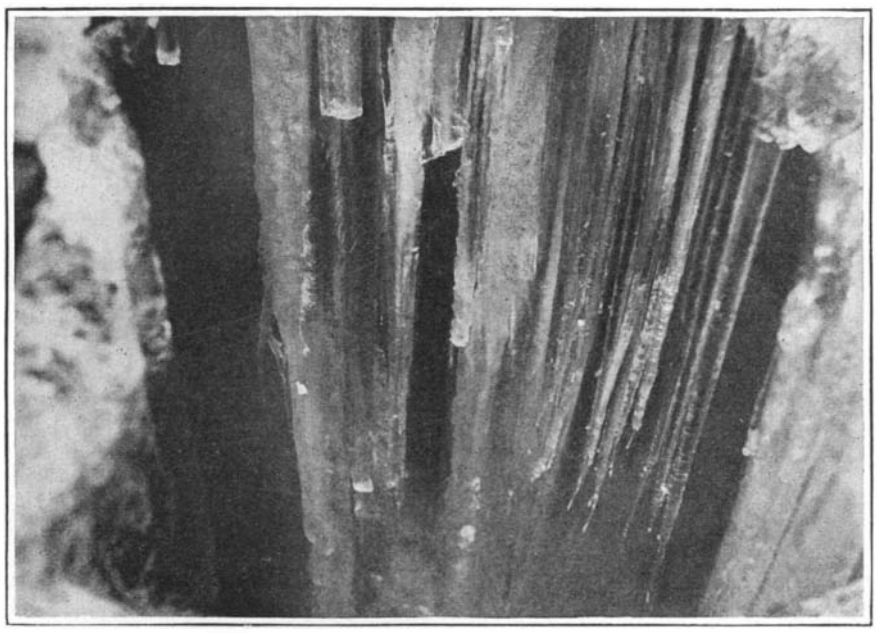

A downward view in the ice mine shaft, showing the huge icicles formed during the summer months

An Ice Mine That Freezes in Summer and Melts in Winter

By Charles Arthur Vandermuelen

UNBELIEVABLE as it may seem, there exists at Coudersport, Pennsylvania, an ice mine. It was discovered some 18 years ago by a farmer who, noting a peculiar coldness---even in the warmest weather---of a certain portion of his farm, was led to dig there in the belief that he would find a deposit of silver. The mine or cave which he unearthed proved to be 40 feet deep and from 10 to 12 feet in diameter. At present, it is entered by means of a ladder, since it is situated on the side of a hill.

Geologists are not able to explain why the mine happens to be where it is, nor why the ice should form, in seeming opposition to the laws of nature, in summer and melt in winter, as it does in this instance. The ice is formed from a peculiar cold mist which comes through openings found all the way from the top to the bottom of the 40-foot shaft. As soon as warm weather arrives, frost appears on the walls of the shaft and soon tiny icicles form rapidly, until in the warmest weather huge icicles, often 2 feet thick, reach from the platform, at the top, to the bottom of the mine. The ice begins forming in May, and in October the thaw sets in.

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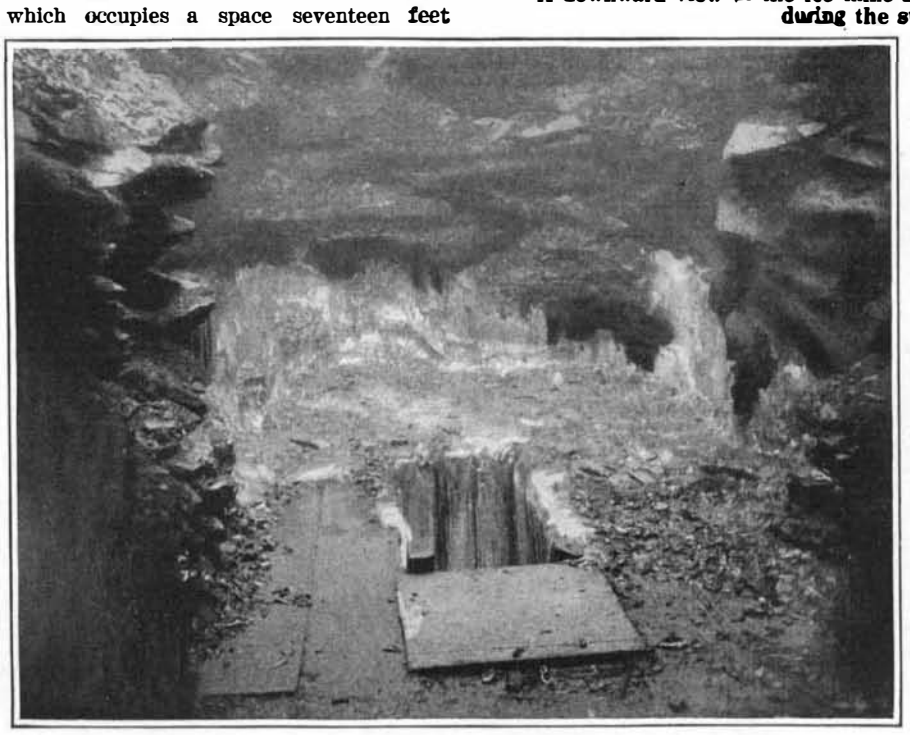
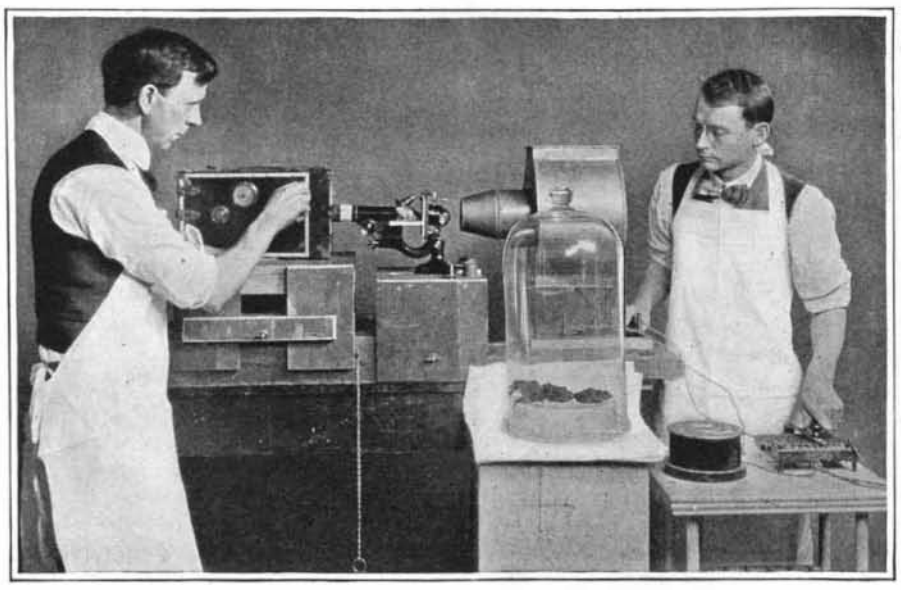
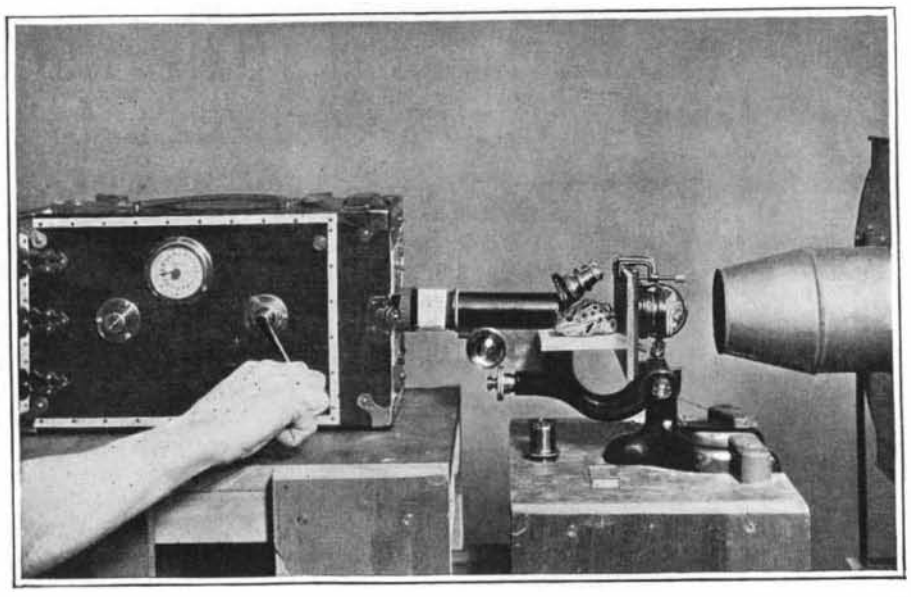


Entrance to the ice mine. The ice forms most rapidly in summer and melts in cold weather

A section of the ice mine shaft which is 40 feet deep, and 10 to 12 feet in diameter



Taking a motion picture of blood circulation in a frog's foot. The light is passed through the subject into the camera lens



The technique of taking motion pictures of blood circulation in a frog's foot, showing the arrangement of the apparatus

The Frog as an Entertainer in Motion Pictures

THE frog has always been a generous contributor to science, his foot having been observed by physiology classes for generations as a visual evidence of the circulation of blood. Advancing with science, he has broken into motion pictures and reel after reel of film showing the red and white corpuscles chasing merrily up and down in the web of his foot will now lend new interest to the physiology lesson.

Micro-motion study of the circulation in a frog's foot has been carried out as a part of the medical research work of a Michigan sanitarium. The object was to provide a graphic demonstration of the principle of blood circulation and also to determine the effect of a large number of therapeutic measures upon circulation. In both these objects success has been reached through the use of an everyday motion picture camera and a high power microscope, a mercury lamp being used for illumination. Mechanically and photographically, the combination produces excellent results; and it is not even necessary to pin the frog's foot to the finding board, a fastening of adhesive tape being sufficient for the purpose.

The pictures obtained have proved highly interesting. The constant movement of the white and red corpuscles up and down the blood stream is made plainly evident. Although corpuscles are only 1-25,000 of an inch in diameter, they may be clearly seen when the film is projected. Color pigment in the skin of the frog shows as plainly as flies on a window pane, and the steady pulsing of blood through arteries and its gentler return through the veins may be readily observed.

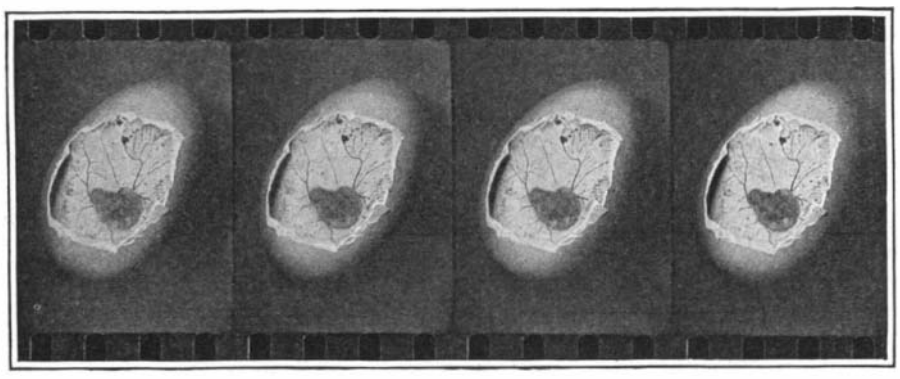
By administering various drugs, food elements, and such therapeutic measures as application of hot cloths or ice, the varying effects upon the circulation are faithfully recorded by the motion picture camera. It has been found possible to deter or accelerate the circulation almost at will. Even the heart can be stopped by interference with certain sets of nerves and started again by the simple expedient of exhilarating other nerves.

Two of the accompanying illustrations clearly depict the arrangement of the apparatus for taking the motion pictures.

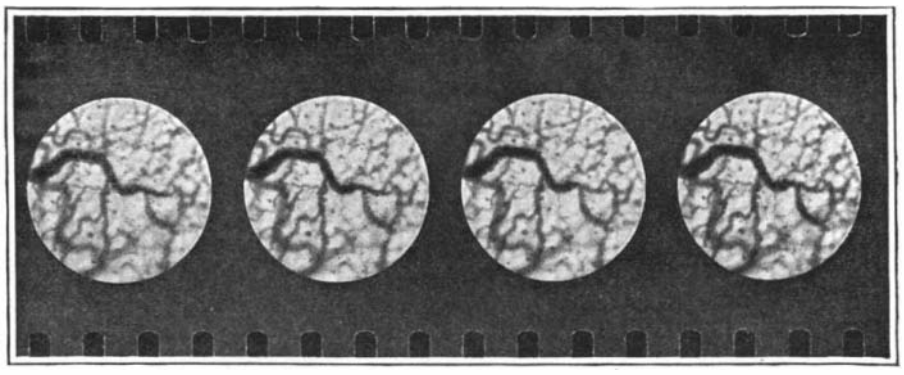
General interest in the films showing the processes of blood circulation has been large. In the parlors of the sanitarium they are shown as an event of diversion for guests, and in this connection they excite as much interest as the most daring exploit of the film heroes from the celluloid settlements of Southern California or the film towns that border on the edge of the Palisades, across the Hudson River from New York City.

A Double-Negative Camera Which Reproduces Images in Natural Colors

ANOTHER valuable contribution has been made toward the development of color photography, this time in the form of a camera that exposes two negative plates simultaneously through the agency of a perforated mirror. Thus there are recorded on the two negatives the red color values and the blue-green color values, respectively, of the image photographed. Subsequently, as the various phases of the process are carried out, positive prints in the form of transparencies with images colored red and green, respectively, are cemented together, the two glasses removed, and the picture mounted on paper, canvas, ivory, or any other material that may be selected.



Filming section of an egg, showing the embryo chick. The film was intended to show the heart beat



Film section of circulation in frog's foot. The larger black stream is a small vein, while the black spots are bits of color pigment in the skin

The new camera and process of color photography are the result of years of research work and experimenting on the part of Percy D. Brewster of New York City. The point of distinct divergence between the Brewster process and other color-photography processes lies in the method of exposing the two negative plates in the camera. Hence the camera will be considered first.

As will be noted in one of the accompanying views representing a sectional view of the camera, this consists of a light-tight box arranged to hold two plates or negatives, *H*, *J* at right angles to each other. It is provided with a lens, *A*, and a shutter, *B*, of conventional pattern, mounted on a movable front board for focusing as in the ordinary camera. *C* is the bulb tube controlling the shutter, while *D* is the bellows and *E* the focusing screw. Between the lens and the negative, *H*, in a direct line with both, there is interposed a nickel or silver mirror, *F*, mounted at an angle as illustrated. This mirror is protected from oxidation, and its surface has been ground and polished to an optical flat by a well-known telescope maker. Through the mirror there have been bored some 100 holes, each at an angle of 45 deg. in relation to the surface of the mirror; for this reason the mirror has come to be known colloquially as the "Swiss cheese" plate. It is essential that any light rays that pass through the holes in the mirror should not be interfered with by the metal backing; accordingly, the sides of the holes have been countersunk at an angle of about 40 deg.

It is an established fact that light radiates from every point in the object to be photographed into the camera lens, and is projected by the lens in the form of a cone upon the sensitive plate, the base being at the diaphragm point of the lens and the apex at the plate. If half of these light rays are cut off, the remainder will form just as perfect an image of the point photographed, although, quite obviously, with only half of the light intensity, thereby necessitating doubling the exposure. This fact is taken advantage of in the design of the Brewster camera in breaking up each one of these cones of light into 20 or more parts; that is to say, each cone is made to strike possibly 10 holes and so transmit to the back 10 beams of light, *K*, which recombine to form the image on the negative plate in line with the lens. Meanwhile, the portions of the cone of light which strike the solid parts of the mirror are reflected at right angles, *L*, and these too reunite to form a perfect image on the second plate, *J*.

In the foregoing discus-

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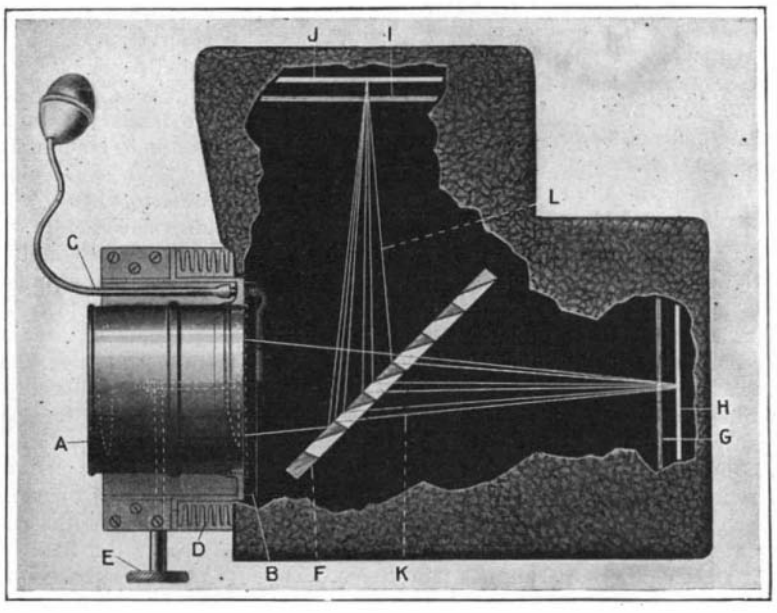
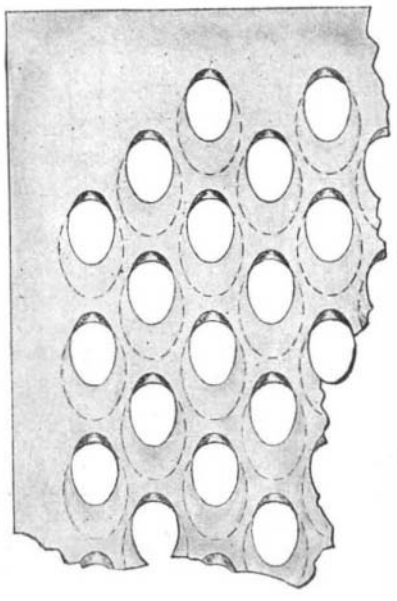


Color-photography camera which exposes two plates simultaneously, partly broken away to demonstrate its operation



The perforated mirror or "Swiss cheese" plate of the new color-photography camera

glass. The various sections, walls, ceilings, stalagmites and other features have been so deftly set that the closest scrutiny fails to detect any of the joints. In keeping with the original cave, clay has been used in modeling the floor formation, and this also will be employed on the exterior.

An Ice Mine that Freezes in Summer and Melts in Winter

(*Concluded from page 470*)

A shelter was erected over the mine some time ago; but it had to be removed, as the ice melted when the sun's rays were kept from the mine.

The mine has been nsed as a cold storage plant by the wife of the farmer, and she claims that eggs have been kept seven month in the natural refrigerator and at the end of that period found to be in perfect condition. During the summer the temperature of the mine ranges from 25 to 30 deg. above zero. This mine, notwithstanding the fact that it is open at the top, is warm enough on the coldest winter's day to keep vegetables without freezing.

The ownership of this natural curiosity has recently changed hands; and now the business men of Coudersport are coöperating with the new owner in an effort to attract more tourists to the place. They are planning an extensive advertising campaign, which will include advertising in automobile guide books. Important improvements on the roads, buildings, and the park surrounding the ice mine are to be carried out before the coming summer. The contemplated opening of the new road running directly past the mine, the Jersey Shore Turnpike, will make visiting the mine and grounds particularly convenient to autoists in the East.

A Double-Negative Camera Which Reproduces Images in Natural Colors

(*Concluded from page 471*)

sion the path of only one point of light from the image photographed has been traced from its source as a point to its expansion as the base of a cone in the lens and its reconversion to a point at the surface of the plate. It must be remembered that a countless number of rays are received by the lens in the making of a photograph and that probably millions of rays pass through each of the holes in the perforated mirror to form the images on the two plates.

It should be explained here that all ordinary photographic plates are color blind, as it were, to everything except blue and violet. They are made color sensitive by treating them with rare dyes, such as pinacyanol and pinachrome, in the weakest sort of solution—one part dye to about one million parts of water, for instance. The first of these dyes makes the plate sensitive to red and orange light rays; the other, to green and blue.

A green filter, *G*, is interposed in front of the direct plate in the color-photography camera, so as to record the object by green light on that plate, while a red filter, *I*, is interposed in front of the plate that is acted upon by the reflected rays or beams of light. Thus it becomes possible to record simultaneously the same object on the two negatives. The exposure in the studio is from two to eight seconds, while in sunlight it is as fast as a fiftieth of a second.

Owing to their sensitiveness to red light, the plates are developed in total darkness. The plates of course appear in black and white; one represents the red record and the other the green record of the object photographed. Both negatives record exactly the same object and register exactly the same size. The point of variation rests in the fact that the red values of the photographed object are recorded with greater density on the red negative while the green values are recorded with greater density on the green negative.

From the two negatives two positive prints in black and white are secured by contact printing, in a manner similar to that followed in making a lantern slide. Following, the image on the positive plate printed from the green negative is dyed red, while the positive from the red negative is dyed green. If a little thought is given to the subject it soon becomes apparent why this reversal in the dyeing is necessary.

The new method of coloring the positive plates was discovered by Mr. Hoyt Miller through many researches made for this process. By this treatment the black and white positive is converted into a pure dye image and the opaque black silver eliminated in a few seconds' time. At the same time the transparent portions of the positives, which form the whites in the final picture, are protected from the slightest discoloration. Plates of great luminosity and brilliancy are secured, with the result that when combined they form a sharp and perfectly colored image without the slightest discoloration in the whites.

The two positive plates, perfectly registered and now cemented together to form the complete picture in the form of a transparency, are ready to be transferred from their glass supports to any other form of support that may be selected. This work is accomplished by carefully removing the emulsions from the plates and stripping them onto their final support, which may be paper, canvas, porcelain or ivory, the latter in the case of a miniature.

Specimens of the work produced with the Brewster camera aud process are most faithful in the reproduction of the image, and the hues found in some of the pictures represent a wide range in the color scale despite the fact that only two of the three primary colors are used. It is the opinion of the inventor of the process that its use is not limited to the taking of photographs: he believes it will eventually find its way into the printing and lithograph trades as a more expedient, less expensive, and a more faithful method of color printing.

NEW BOOKS, ETC.

PRACTICAL ELECTRICAL WIRING. By John M. Sharp. New York: D. Appleton and Company, 1916. 12mo.; 256 pp.; illustrated. Price, $1 net.

In this manual the student is introduced to the principles and practice of wiring for and installing the required fittings for bells, motors, telephones, and lights. The method of distributing current by different systems is simply explained; there are wiring tables and data that will be of material assistance in actual work, and methods are suggested that may lead to a saving of time and material and an increase in profits. There are also abstracts from the National Electric Code, and throughout the work an effort has been made to comply with the rules of this Code.

COLOUR. A Handbook of the Theory of Colour. By George H. Hurst, F.C.S. Second edition, revised by H. B. Stocks, F.I.C., F.C.S. London: Scott, Greenwood & Son, 1916. New York: D. Van Nostrand Company. 8vo.; 160 pp. Price, $3 net.

"Colour" is a British manual particularly addressed to artists, painters, dyers, calico-printers, and decorative designers. The cause and effects of color, and the results obtained from various mixtures and combinations, are carefully explained, and there are chapters on such subjects as the physiology of light, contrast, and the measurement of color. The numerous plates adequately convey the appearance of the absorption spectra of dyes, the effect of mixing colors, color contrasts, and the three-color process of printing. Those craftsmen who care to possess more than a merely superficial knowledge of their work will find in this volume much illuminating and interesting exposition, and will be helped to a firmer grasp of those principles that so greatly contribute to artistic and satisfying results.

THE PRACTITIONER'S MEDICAL DICTIONARY. By George M. Gould, A.M., M.D. Third edition, revised and enlarged by R. J. E. Scott, M.A., B.C.L., M.D. Philadelphia: P. Blakiston's Son & Co., 1916. 8vo.; 962 pp.; illustrated. Price, $2.75.

The various Gould dictionaries need no introduction to the profession, and this revised and enlarged edition of "The Practitioner's Medical Dictionary" is worthy of the highest praise. A nice discrimination has been exercised upon the work, resulting in the retention of all the terms in current use, with the addition of many of the words of allied sciences; yet the volume has been kept well within a handy size and weight. Derivations are carefully given, and pronunciation, instead of relying upon diacritical marks, is indicated by a phonetic respelling. The definitions are sharp and accurate, and the type clear. This edition presents no less than 20,000 new terms, bringing the total number of words up to more than 70,000.